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# Understanding the Mobile Gaming Context and Player Behaviour: A Review and a Research Agenda

*Full Paper*

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## **Abstract**

The technological developments in mobile network and mobile computing underpin the dominance of mobile games in the global games market. Extant literature has enriched our understanding on the antecedents of playing mobile games, yet we still lack a comprehensive portrait of this unique gaming context that is distinguished from the context of traditional computer or console gaming. In response, we conduct a literature review to review research gaps on extant mobile gaming literature. Through a review of 181 works, we propose a framework based on the environmental psychology theory to guide future research to investigate the mobile gaming context. Drawing on this framework, we elaborate a research agenda that proposes potential research questions for future research to study the impacts of 1) mobile game design features and mobile application usability, 2) the use context more broadly, and 3) subjective individual differences, on mobile game player's gaming experience, continued playing intention and in-game purchasing.

**Keywords:** Freemium, Mobile games, Post-adoption behaviour, Use context, Literature review

## 1 INTRODUCTION

The advancements in the mobile communication technology (e.g. increasing availability of 4G network) and the increasing smartphone penetration around the world have enabled a ubiquitous mobile environment where “people can be connected to the internet anytime and anywhere” (Kim et al. 2019, p.1), and such environment also has changed the way people play video games (Jeong and Kim 2009; De Prato et al. 2014). Mobile games that are “defined as games conducted in handheld devices with network functionality” <sup>1</sup>(Jeong and Kim 2009, p.290) have become the predominant segment in the global games market with the largest number of players (2.2 billion) and 51% market share by revenue (\$70.3 billion) that overtakes the revenue sum of computer and console games (Newzoo 2018). Mobile technology developments also disrupt the way that game developers distribute and monetise their games (Chulis 2012; De Prato et al. 2014). For the distribution channel, unlike game developers of computer and console games who have to rely on intermediaries such as distributors and retailers to sell their games to the end users, mobile game developers only distribute their games via online digital platforms such as App Store and Google Play (De Prato et al. 2014). As to the business model, it is noticeable that most mobile games adopt a “free-to-play” (freemium) model to design the gameplay and game contents (Chulis 2012; Liu et al. 2014). In other words, game players can grab a mobile game for free, but they need pay for in-app purchase of contents such as premium app update (Liu et al. 2014), virtual items, and view in-app advertising to upgrade their gaming experience (Hamari and Keronen 2017). However, under such business model, the competition in this market is quite harsh since it is challenging for game developers to retain their game players, even for those top performing games that have only 15%- 30% returning players after a week of playing (GameAnalytics 2018). The reason for the high intensity of competition and low retention rate in the mobile game market can be explained by the nature of the freemium model. In the freemium model, users have low barriers to drop out during the initial days of trial of a mobile game (Civelek et al. 2018; Liu et al. 2014) as they have numerous choices in the mobile game app market. In addition, given that enormous number of new mobile apps are released per day in digital distribution platforms, the product life cycle of mobile apps is much shorter than that of traditional product categories (Yi et al. 2019). Consequently, mobile games are different from their counterparts of traditional computer games regarding the game design and the gaming experience provided to players since their revenue streams greatly depend on the continued playing (Tim et al. 2018) and the in-game content purchasing (Hamari and Keronen 2017). Such a unique gaming context deserves scrutiny to provide an in-depth understanding of the mobile gaming context and player behaviour that is unique in the gaming realm.

Against such backdrop, the purpose of the present study is to conduct an in-depth analytical literature review of the current knowledge on mobile gaming and to propose a research agenda, based on the analytical review results, for future research. In correspondence with the research purpose, the present work sets forth to study the following research questions: What are the characteristics of the mobile gaming context? How can a broader conceptual view of the gaming context inform a better understanding of mobile gaming experience, game player’s continued playing of mobile games and in-game purchasing?

## 2 METHOD

The literature review process and analysis are guided by the studies of Vom Brocke et al. (2009; 2015) and Webster and Watson (2002). Specifically, we adopted the guidelines from Vom Brocke et al. (2009) that comprises five steps to 1) define the review scope, 2) conceptualise topics and concepts, 3) search the literature, 4) analyse and synthesise the found literature and 5) consider possible research agenda.

Step 1 and Step 2: In line with the breadth of our research questions, the boundary of the literature review is bounded to mobile gaming works on individual behaviours of playing mobile games on entertainment situations. Before we started the formal review process, we initially performed overall queries with “mobile game” or “video game” or “computer game” against Elsevier’s Scopus, Google Scholar and Thomson Reuter’s Web of Science to develop fundamental understandings of the subject matter and the coverage of literature to capture a foundation for the literature search (Vom Brocke et al. 2015). The results of initial searches showed that traditional video game research is a broader research area than that of mobile gaming as mobile game works are frequently informed by traditional video game studies. As a result, it is beneficial for the present study to conduct two rounds of literature reviews

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<sup>1</sup> The present research defines mobile gaming as gaming conducted on handheld devices with network functionality such as mobile phone and tablet, while a broad definition of mobile games could include portable game-dedicated devices such as Nintendo Switch. In addition, the present study only considers commercial mobile games on entertainment situations.

in which a review of traditional video game research is conducted first and then followed by a second-round review on mobile gaming research. Initial searches also enabled us to define our inclusion and exclusion criteria and keywords for the literature search. For the exclusion criteria, while we found a group of studies focusing on serious game, advergame, and educational game with an emphasis on game-based learning behaviours, these types of studies were ruled out from our review results. Specifically, for the video gaming literature, works focusing on games designed for treatment or rehabilitation and works targeting at game-based behaviours such as aggression, abuse and frustration were also excluded because the focus of those studies is the pathology of game-based behaviours themselves instead of gaming behaviours, thus being far from our research questions. For the inclusion criteria, we defined that a paper must discuss topics regarding game design features, gaming experience, and player behaviours that include adoption, usage, continuance, player loyalty and in-app purchasing. Furthermore, we found that video game research spans across various disciplines including communications, education, information systems, marketing, media psychology, and software engineering. As a result, we claim that our literature searches are representative for IS (information systems) research by mainly collecting publications in IS research and a few of works from marketing to “typify a larger body of publications” (Vom Brocke et al. 2015, p.214) of video game research.

Step 3: the literature search process started with browsing IS literature in the journal list indicated by Fisher and Lamp (2007) combined with the eight journals in the AIS senior scholars' basket. In addition, based on our initial searches, extra 12 journals<sup>2</sup> were added in our browsing list since these journals cover a group of video game studies, thereby 40 journals in total in our review list. We firstly used the following search operators, “game\*” OR “player\*” OR “playab\*” NOT “game-theoretic” to query video game research from the databases of each journal in terms of the abstract, keywords, or field of anywhere. For the selection decision of each search result, the full paper in PDF format was downloaded and the full paper was entirely read and reviewed by reviewers. This round of review identified 136 works of video game research. We then proceeded to use search operators, “mobile game\*” OR “mobile gaming” OR “gameplay\*” to browse mobile game studies from the databases of each journal in the same way we did in the last review round, and all the search results were reviewed using the same review criteria, and 45 results were identified. Furthermore, in order to refine our review results, we then adopted a backward and forward search proposed by Webster and Watson (2002) to identify common citation information from both research streams.

Step 4 and Step 5: After the literature search, each search result was classified and analysed based on the concepts and themes that were frequently discussed inside the search results (Webster and Watson 2002), and we detail the results in section 3. Because of the space limitations (i.e. reference list), the tables in section 3 only include reference to a few selected publications for each theme identified. Based on the review results in section 3, we discuss the identified research gaps of mobile game research and outline potential avenues for future research with a research agenda proposed in section 4.

### 3 FINDINGS

The analysis of all the 181 studies enabled us to synthesise 8 research themes in video game research and 7 in mobile gaming research. Starting from video gaming research and followed by mobile gaming research, we elaborate on each research theme as follows.

For video game research:

*Motivations for playing games:* this research area emphasises on disentangling why people play video games. Discussions cover individual's motivations to play games (Yee 2006), and adoptive behaviours in IS adoption and usage to play games (Hsu and Lu 2004; Wang and Scheepers 2012). *Motivations for continued playing of games:* given that a gamer will quickly stop playing a game even though he or she has already installed and tried that game, it is important to check why people continually play games. Studies focus on investigating the continued intention to play games (Li et al. 2015) and player loyalty to a specific game (Huang et al. 2017; Liao et al. 2019). *Game design:* this theme focuses on investigating what game design features or contents deliver a successful video game and how game design features affect game players' gaming experience. For instance, gaming experience is affected by game design features such as challenge (Sepehr and Head 2018), fantasy (Choi et al. 2013), and social element (Christou et al. 2013; Wadley et al. 2015).

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<sup>2</sup>They are Computers in Human Behavior, Electronic Commerce Research and Applications, Information, Communication & Society, International Journal of Human-Computer Interaction, International Journal of Information Management, Internet Research, Information Systems Frontiers, Personal and Ubiquitous Computing, Technological Forecasting and Social Change, Telematics and Informatics, Journal of Business Research, and Journal of Interactive Marketing.

Theme	Definition	Selected Publications
Motivations for Playing Games	The determinants and factors that explain why people play video games	Hsu and Lu (2004), Wang and Scheepers (2012) and Yee (2006)
Motivations for Continued Playing of Games	The determinants and factors that explain why people continually play video games	Huang et al. (2017), Li et al. (2015) and Liao et al. (2019)
Game Design	Game design features or contents affecting game player's gaming experience	Christou et al. (2013), Li et al. (2014), and Wadley et al. (2015)
Gaming Experience	A game player's subjective feelings generated from gaming or special gameplay	Liao et al. (2019), Sánchez et al. (2012), and Sepehr and Head (2018)
Game Player Characteristics	A game player's demographic traits, personality and similar game playing behaviours and preferences shared by a group of people	Huang et al. (2017), Liu et al. (2013), and Wang and Sun (2016)
Gender Difference	The differences of gaming behaviours happened between female and male gamers	Liu (2016), Jansz et al. (2010), Kaye and Pennington (2016), and Vermeulen et al. (2017)
In-game Content Purchase	A game player's intention to purchase in-game contents	Hamari et al. (2017) and Jin et al. (2017)
Influence of Gaming on Daily Life of Gamers	The impact of playing video games on gamers' offline life or the gamers themselves	Chen et al. (2019) and Lee et al. (2018)

*Table 1. Findings of Video Game Research*

*Gaming experience:* this theme emphasises on game players' behavioural process in playing games and unique gaming experience experienced by players such as playability, flow and enjoyment. For example, Sánchez et al. (2012) scrutinise what playability means for gamers and identify 6 dimensions of playability. Sepehr and Head (2018) investigate how the player's experience of competition affect their playing engagement. *Game player characteristics:* this research topic examines the difference of game playing behaviours caused by gamer traits such as gender, age, gamer identity, level of gaming skills and personality. For example, Huang et al. (2017) investigate how personality traits of different gamers will lead to different responses to a same game design feature, thereby affecting gamer loyalty. *Gender difference:* gender difference is a sub-theme of the game player characteristics, but this sub-topic attracts a lot of attention from scholars. Related discussions include the effects of sexual stereotype on game genre (Vermeulen et al. 2017), stereotypical threat for female gamers (Kaye and Pennington 2016), gender difference on gaming (Liu 2016), and gender difference on play motivation (Jansz et al. 2010). *In-game content purchase:* this research theme works on uncovering the determinants and factors that trigger a gamer's purchase intention on in-game contents. Jin et al. (2017) indicate that gamer engagement and social presence positively affect gamer's intention to purchase virtual products. Hamari et al. (2017) identify six dimensions of in-game content purchase motivations. *Influence of gaming on daily life of gamers:* this theme discusses how individuals' playing of games affect themselves and their offline life. Chen et al. (2019) examine the effects of video game exposure combining with other socioeconomic factors on the school performance of primary and secondary school students. Lee et al. (2018) find that a game player's online leadership will influence offline leadership which is partially mediated by game achievements and character identification and is moderated by game player interactivity.

Theme	Definition	Selected Publications
Motivations for Playing Mobile Games	The determinants and factors that explain why people play mobile games	Ha et al. (2007); Park et al. (2014), and Rauschnabel et al. (2017)
Motivations for Continued Playing of Mobile Games	The determinants and factors that explain why people continually play mobile games	Chen et al. (2018), Liu et al. (2018), Merikivi et al (2017), and Wei and Lu (2014)
Mobile Game Design	Mobile game design features affecting game player's gaming experience	Chen et al. (2018) and Merikivi et al. (2017)
Gaming Experience	A game player's subjective feelings generated from gaming or special gameplay	Baek and Touati (2017)

Theme	Definition	Selected Publications
Game Player Characteristics	A game player's demographic traits, personality and similar game playing behaviours and preferences shared by a group of people	Baek and Touati (2017), Cota et al. (2015), Ha et al. (2007); Pappas et al. (2019) and Xu et al. (2016).
In-game Content Purchase	A game player's intention to purchase in-game contents of a mobile game	Hamari et al. (2017), Hamari and Keronen (2017), and Hsiao and Chen (2016)
Gaming Context	The environment in which mobile games are going to be played	Kim et al. (2019) and Liu et al. (2018)

*Table 2. Findings of Mobile Game Research*

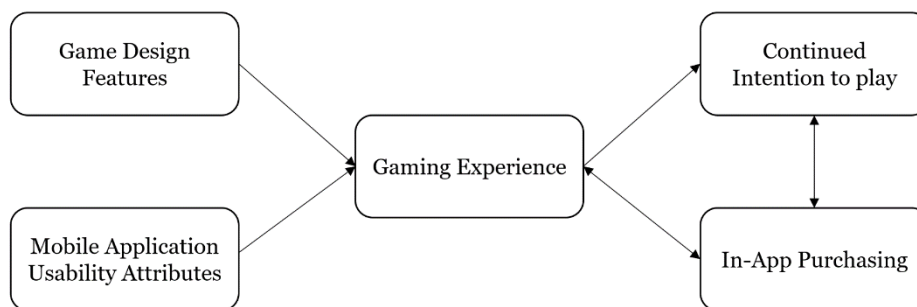
For mobile game research:

*Motivations for playing games and continued playing of mobile games:* in these two research veins, mobile gaming research is close to video game research that focuses on uncovering gamer's behavioural factors and psychological demands to initially play and continually play a mobile game. Key constructs including perceived usefulness (Ha et al. 2007; Park et al. 2014), attitude (Ha et al. 2007; Rauschnabel et al. 2017), and satisfaction (Park et al. 2014) are identified as antecedents to playing intention. Key factors of continued playing identified include perceived enjoyment, social interaction, achievement, and flow experience (See Chen et al. 2018; Merikivi et al. 2017; Wei and Lu 2014). *Game design:* compared with video game research, mobile gaming research focuses more on how mobile game design features affect (mediated by gaming experience) gamers' playing intention or continued playing intention. Merikivi et al. (2017) investigate how continued intention to play is affected by game design and playability. Furthermore, some studies identify unique game design features that differentiate mobile gaming from traditional video games (e.g. 'Serendipity' in Chen et al. 2018). *Gaming experience:* most studies in this theme consider gaming experience as the mediator or antecedent to affect gamers' playing or continued playing intention (see the first two research themes). Only a few of them dive into gaming experience in detail. For example, Baek and Touati (2017) study the enjoyment of gaming in detail by investigating the impacts of students' learning style, collaborating skills and intrinsic motivation on their enjoyment of gaming. *Game player characteristics:* mobile gaming research focuses on how player's gender (Ha et al. 2007), age (Cota et al. 2015), personality (Xu et al. 2016) and other individual traits such as gameplay time (Baek and Touati 2017; Pappas et al. 2019) affect gamers' gaming experience, and their intention to play mobile games. However, gender difference was not identified as a distinct sub-theme of game player characteristics under the mobile gaming research. *In-game content purchasing:* this stream investigates the monetisation strategy of F2P mobile games by identifying behavioural factors motivating players themselves to buy in-game contents such as expectation of unobstructed play (Hamari et al. 2017), and game design features such as the balance between "fun" and monetisation in the game design (Hamari and Keronen 2017) and pricing optimisation on virtual items (Civelek et al. 2018, Harviainen et al. 2018). *Gaming context:* this unique research theme under mobile gaming research assumes that an individual's rational behaviours are not just influenced by their affective and cognitive processes, but such processes should be affected by the objective use context as well. Kim et al. (2019) indicate that a gamer's intention to play will be influenced by the temporal, locational, social and technological use contexts. Several studies also identify one or two contextual factors in mobile gaming (e.g. 'Situation stimulus' in Liu et al. (2018), and 'Time Flexibility' in Wei and Lu (2014)).

## 4 DISCUSSION

The two tables in the previous section show that traditional video game research has a more in-depth investigation in areas of game design features, gaming experience, gamer traits and the impacts of gameplay on offline daily life of players than mobile gaming research, but mobile gaming studies have their own special research topics under in-app purchasing and gaming context. Following our research purpose, we propose a framework to help understand the phenomenon for future research. This framework illustrated in figure 1 conveys our main idea for the whole future works, and it consists of 6 critical components: 1) game design features refer to gaming contents and gameplay elements that interact with and are experienced by game players within a video game; 2) mobile app usability attributes refer to "the extent to which a mobile application can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (Hoehle and Venkatesh 2015, p.437); 3) the gaming experience; 4) game player's continued intention to play; 5) game player's in-app purchasing; 6) moderators from the mobile gaming context including the use context

and individual differences regarding player characteristics such as age, gender and personality affecting the mobile gaming experience. The framework is meant to provide broad guidelines for both qualitative and quantitative future research. Thus, it is left for future research to determine, for example, how the gaming context influences gamer behaviour. This framework builds upon the theoretical perspective of environmental psychology (Mehrabian and Russell 1974) by arguing that various formats of environmental cues as stimuli (S) affect individual's internal cognitive and affective processes (organism)(O), which subsequently lead to their final response towards the stimuli (R). The SOR model assumes that individual's rational behaviours are not directly influenced by his/her affective or cognitive processes, but such processes are affected by environmental cues in advance. In other words, different facets of the environment such as product attributes (Fang et al. 2017) and artefacts or spatial arrangement (Animesh et al. 2011) act as external stimuli (S) that affect individual's internal cognitive or organismic experience (O), thereby leading to behavioural responses of users towards the environment (R). In IS research, this theoretical perspective has been applied in different contexts including online shopping to investigate how the website design features as environmental cues affect customer's purchase intention (Parboteeah et al. 2009). Because of the mobility and ubiquity of mobile gaming (Kim et al. 2019; Wei and Lu 2014), we argue that a mobile game player's gaming experience is different from the gaming experience in traditional video games. In addition, prior works on mobile application demonstrate that the design of a mobile app will affect the use experience and continued intention to use the app (Fang et al. 2017; Hoehle and Venkatesh 2015), thus we consider the mobile app usability factors as environmental cues and the design features of a mobile game as environmental cues affecting a game player's gaming experience, thereby triggering their continued intention to play and in-app purchasing. Given that gaming experience (as a cognitive and affective process) is the crux for mobile gaming under the freemium model to retain game players and to generate revenue via their purchasing on in-game contents (Civelek et al. 2018; Harviainen et al. 2018), we identify game players' continued intention to play and in-app purchasing as the responsive behaviours in our framework. The remaining of this section will elaborate our research agenda with potential avenues for the future mobile game research.



*Figure 1. Framework of Future Research Agenda for Mobile Gaming Research in Information Systems*

#### 4.1 Mobile Game Design Features

The game design features not only affect players' gaming experience (Li et al. 2014; Wadley et al. 2015), but also affect their intention to purchase virtual items in games (Hamari et al. 2017). While a few of recent studies have noticed the significance to examine the impacts of game design features on gaming experience (Merikivi et al. 2017) and in-app purchasing (Civelek et al. 2018; Harviainen et al. 2018) in the mobile game context, more both theoretical and empirical research should be conducted to uncover the influence of mobile game design features on game players' continued playing intention and in-app purchasing. In addition, it should be noticed that a mobile game is not just a video game but also a mobile app in general, thus the mobile application usability attributes should not be ignored in this research stream. In the mobile computing environment, fundamental mobile app performance attributes such as compatibility of interaction in small size screen with multi-touch have been demonstrated having significant effects on a user's engagement to use a mobile app (Fang et al. 2017; Hoehle and Venkatesh 2015). While the concept of mobile application usability has been widely applied and examined in the context of utilitarian IS (see Hoehle and Venkatesh 2015), research on the mobile application usability working as a fundamental mechanism to support a hedonic IS running, to the best of our knowledge, is still limited. In this sense, based on studies of Merikivi et al. (2017) and Harviainen et al. (2018), we suggest that a more in-depth understanding of mobile application usability and game design features, informed by typical video game studies, can benefit mobile game research for a more precise understanding of player behaviour. Future research could address research questions, such as:

What are the effects of game design features and mobile application usability on mobile gaming experience?

Moreover, for mobile games under the F2P model, their revenue streams are more affected by players' purchases on in-game contents such as premium app update (Liu et al. 2014), virtual items and removal of in-app advertising to upgrade their gaming experience (Hamari et al. 2017). In this sense, it is important for the design features of a mobile game to achieve a balance between monetisation and gaming experience where most players keep playing the game and their continuance is not pulled down by the "pay-to-win" (Hamari et al. 2017; Harviainen et al. 2018) since the value of virtual goods is bound to the environment where they are usable in (Hamari and Keronen 2017). In this sense, future research can draw on research questions to investigate the in-app purchasing in the mobile gaming context, such as: How do the design features affect a player's in-app purchase behaviours and how can a balance be achieved between monetisation and gaming experience?

More importantly, future research should also be careful about the causality direction between in-app purchasing and continued playing intention or gaming experience. While studies indicate that gamer loyalty or continued playing intention leads to gamer's in-app purchase (see Hamari et al. 2019; Hsiao and Chen 2016), we argue that game players' in-app purchasing will recursively affect their gaming experience and continued playing intention. Such reciprocal influence is close to the discussion in Chang and Chen (2018) that player loyalty will reversely affect intention to play and satisfaction. However, such recursive or reciprocal relationship in mobile gaming context remains a topic for future research to clarify. Thus, we suggest that future research can adopt a longitudinal research to investigate: What are the impacts of in-app purchasing on mobile gaming experience and gamers' continued intention to play? Also, qualitative research can investigate why and how the virtual game contents match or do not match game player's expectations regarding their purchases.

## **4.2 Broader Understanding of the Mobile Gaming Context**

According to Kim et al. (2019, p.4), "the use of technologies is understood as part of human activities" where the meaningful objective contexts, subject users engaged in the activities and the technology as tools used by users consist the user activity. Thus, we argue that both the objective use context and subjective player characteristics deserve further research in order to get a broader understanding of the mobile gaming context since gamers with different traits will respond differently to the use contexts.

### **4.2.1 Objective Use Context**

In section 3, we argued that unique characteristics of mobile game that differentiate it from traditional video game are the ubiquity and the mobility to play the game (Jeong and Kim 2009; De Prato et al. 2014). The concept of use context that refers to "the very concrete environment in which technology is going to be used" (van de Wijngaert and Bouwman 2009, p. 86) has been identified as important construct by IS researchers to investigate IS adoption and usage behaviours in the mobile computing context (Liu and Li 2011; Kim et al. 2019). While most mobile game studies typically emphasise on game player's affective and emotional perceptions from gaming experience such as flow and perceived enjoyment (Ha et al. 2007; Merikivi et al. 2017), the research studying use context in mobile gaming context is still in paucity. Although a few of works on location-based augmented reality game (Chen et al. 2018; Hamari et al. 2019; Rauschnabel et al. 2017) and mobile game adoption (Liu and Li 2011; Park et al. 2014; Wei and Lu 2014) identify several use context constructs in their research (e.g. 'serendipity' in Chen et al. 2018; 'use context' in Liu and Li 2011; 'time flexibility' in Wei and Lu 2014; 'perceived mobility' in Park et al. 2014), these studies only consider one or two specific use contexts in the mobile gaming context and "lack theoretical background" of use context (Kim et al. 2019, p. 2). Getting to this point, we suggest that rather than overemphasising on identifying users' behavioural factors and emotional feelings to initially and continually play mobile games, mobile game studies can benefit from a better understanding on what and how use contexts in mobile gaming context affect player's gaming experience and how they moderate the impacts of game design features on gaming experience and continued intention of playing mobile games. Kim et al. (2019)'s conceptualisation of the use context in mobile computing environment is a solid starting point for the application of the use context in mobile gaming research, but more empirical research is needed to investigate the use context under hedonic IS context (Wang and Scheepers 2012). The study of Liu et al. (2018) is another great starting point for mobile game research to investigate how the use context affects player's continued intention to play and gaming experience. Consequently, future research can be based on the works of Kim et al. (2019) and Liu et al. (2018) to investigate: How can a broader conceptualisation (i.e. user and objective use context) of the use context help understand mobile gaming behaviour? How are gratifications of gaming affected by the use contexts? How do the effects of use context moderate the impacts of game design features on gaming experience, continued intention to play and in-app purchasing?



#### 4.2.2 Gamer Characteristics

Kim and Lee (2017) suggest that individual attributes lead to different gaming experience and game preferences but research only drawing on demographic factors may provide limited insights on viewing current game player's game tendency. Consequently, more research should be conducted to provide a nuanced understanding on the impacts of player characteristics on mobile gaming experience, thereby affecting their continued intention to play and in-game purchasing behaviour.

Gender difference is one of the fruitful avenues to pursue since mobile game studies that investigate female players are still in paucity. Future research could study what kinds of mobile game design features are specifically attractive for female players and how these features or contents affect female player's continued playing intention, player loyalty to a specific mobile game and in-app purchasing. More importantly, future research should notice the danger of gender essentialism by assuming the gender binary that all females share the same behaviours (Jansz et al. 2010). However, video game studies have indicated that gender difference is more complicated beyond gender binary in gaming context given the influence of other player characteristics such as player's prior experience to play video game (Huang et al. 2017), age (Jansz et al. 2010, van Reijmersdal et al. 2013), and gamer identity (Vermeulen et al. 2017). Thus, for those studies applying the gender binary on mobile game playing (Ha et al. 2007; Li et al. 2015), their results need to go further to understand the nuances of player behaviour (Kim and Lee 2017). In this case, future research can conduct qualitative research to explain the effects of gender difference on the gaming experience or continued intention to play mobile games. For example, the study of Pappas et al. (2019) that adopts fuzzy-set qualitative comparative analysis to provide nuanced gender difference on the intention to download mobile games provides a starting point. Future research could address research questions, such as: What are the constructs of gender difference in the mobile gaming context? How does gender combined with other gamer traits moderate the effects of mobile game design features on gaming experience?

Moreover, other player characteristics such as gamer identity, gaming skill and personality also deserve more in-depth investigation in mobile gaming research. For example, Liu et al. (2013) indicate that a game player's perceived enjoyment and arousal resulting from playing a game will be moderated by the level of their gaming skills as compared to their matchups. In addition, Pappas et al. (2019) suggest that player's intention to download mobile games can differ within the same gender group. Both female and male players' intentions are moderated by their gameplay time, perception on game content quality and price value, and emotions generated when playing mobile games. In this regard, based on existing studies on player personality (Huang et al. 2017), gamer identity (Vermeulen et al. 2017), gamer curiosity (Kim and Lee 2017), gaming skill (Liu et al. 2013) and characteristics of the aged (Cota et al. 2015; Wang and Sun 2016), future mobile game research can investigate how these nuanced player traits moderate the effects of mobile game design features on gaming experience, continued intention to play and in-app purchasing.

## 5 CONCLUSION

The present study identifies the knowledge gaps from existing mobile gaming research through a literature review on empirical evidences of mobile gaming and traditional video gaming researches. We present a framework based on the environmental psychology theory for a future research agenda of the mobile gaming research in the IS realm. Future works can pursue the following three avenues to thrive the mobile gaming research: 1) how the mobile game design features and mobile application attributes affect player's gaming experience, thereby affecting their continued intention to play and in-app purchasing; 2) what are the effects of the use context on mobile gaming experience; 3) what are the intertwined player characteristics and how do they moderate the whole mobile gaming experience.

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